

SCIENCE.

FRIDAY, MAY 8, 1885.

COMMENT AND CRITICISM.

IN ALL BRANCHES of science where the observer deals with the forms of objects, it is more or less desirable that an average of the shapes of the objects should be attained. This end has hitherto been sought through a system of measurements, which is at best a clumsy method, suited only to determine the average of some single dimension; for, where it is the aim to present to the eye a normal or typical form, it is quite incompetent to serve the desired end. So far the beautiful method of composite photography devised by Francis Galton has only been applied to the human face, with the single exception of Dr. Billings's experiments in craniology: if it can be carried into no other fields, it will still remain one of the most important contributions to the graphic resources of science. But the naturalist who has felt the need of this resource in various directions is drawn to consider how far its use may be extended to other branches of inquiry. It seems at first sight that there may be use for it in obtaining the normal or average form of all objects which do not depart too far from a mean shape. It may be that the zoölogist or botanist who wishes to present a picture giving the normal aspect of a variable species, can, by selecting for delineation individuals of the same size, present to the eye a composite combining the general features, and neglecting the individual variations. In this way we shall be able to give to the term 'normal form' a definite and valuable meaning which has hitherto been wanting. It will also be remembered that the late Professor Agassiz laid particular stress on form as the underlying element of 'family' structure among animals; and this would seem to offer an opportunity to test experimentally the view held by the great naturalist.

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It may also be hoped, that, in certain lines of inquiry in the inorganic world, this method of graphic averaging, this Galtonizing process, if we may so term it, will be of great use. Yet, important as are the prospects for the extension of this method of delineation to other fields of inquiry, its greatest use must be in the study of the human body. There this admirable process is full of promise. It may, for instance, be possible to secure an average picture of our school-children at different ages, which will give us a new measure of their condition, and so help us in what is perhaps the most important branch of social inquiry. The effect of occupations, and the results of different methods of physical culture, can also be accurately compared. It may be serviceable in testing the action of different systems of training on young soldiers, as also the influence of their accoutrements on the form of the body. So, too, the effects of certain diseases on the bodily form may be ascertained, to the great gain of medical science. Indeed, the possibilities of this method crowd on the mind. Practice may show limits to its use, and will doubtless do much to overcome certain difficulties evident at the outset of the work.

The charming composite photographs for which we are to-day indebted to Professor Pumpelly show the admirable results which may be obtained, and at the same time some of the critical difficulties of the process. No one can look upon them without a new respect for that shadowy thing called the normal man. There is a singular dignity in these combined shadows: they are strong faces, those of high-browed, deep-eyed, earnest-looking men, fit for all sorts of trials. But most of those who review the faces of American men of science will recognize that in figs. 2 and 3 one face appears, curiously, to dominate all the others, yet which, taken by itself, is perhaps the most

individual of all those contained in the plate. It would be interesting to know what effect on the composite its absence would produce. This element of what we may perhaps call prepotency is most likely to disturb these composite delineations; for, though in itself a very interesting phenomenon, it seems to be somewhat of an obstacle in this use of the new art. With this great contribution of Galton well in hand, we may at length hope that we shall be able to enter upon the study of that unexplored realm of the human face, and physiognomy become a tolerably exact science. Some such process as this seems to offer the only chance of obtaining valuable generalizations in this field of inquiry.

THE CITIZENS' committee of Montreal, formed to arrange for the entertainment of the British association last summer, has every reason to be congratulated on the success of its enterprise. Not only was the meeting a marked success in every point in which the citizens' committee had power to contribute to it, but the report presented at its final meeting a fortnight ago showed with what care it had employed the funds intrusted to it. Parliament granted \$20,000 toward passage-money to the British members; and this was so carefully expended and accounted for, that there remains a considerable sum (about \$2,600) to cover in to the treasury, — a new experience for a parliamentary grant of this sort. The Dominion government further voted \$5,000 for general expenses, the corporation of Montreal an equal sum, and the citizens subscribed \$4,580.97. This, too, has been managed with such care, that, apart from the expenses of the meeting, the committee is able to publish an edition of fifteen hundred copies, largely for gratuitous circulation, of a volume of economic papers, and then have on hand a surplus of \$1,500. This the committee recommended should be given to McGill college in recognition of, and partial compensation for, its liberality in placing the building and grounds of the university at the disposal of the association. This was

voted with the understanding that it should be used in some special way, such as for prizes or scholarships, to commemorate the meeting of the British association in Montreal. The success of the work of the committee was believed to be largely due to the excellent judgment and unwearied service of Mr. D. A. P. Watt and Lieut.-Col. Crawford, to the former of whom his associates presented a pleasing memento.

LETTERS TO THE EDITOR.

**.* Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The ontogeny and phylogeny of the hypoglossal nerve.

It cannot be otherwise than gratifying when two investigators, travelling along entirely distinct paths, unknown to each other, find themselves suddenly brought face to face upon the same stand-point. Haeckel's dictum, that the ontogeny of any form is a brief recapitulation of its phylogeny, is continually receiving confirmation, and, taking into consideration cenogenetic modifications, may be accepted as a dogma. If, then, a theory as to the past history of any form or organ which has been deduced from embryological data is also to be deduced (and that, too, independently) from comparative anatomical studies of adult forms, there are strong reasons for its acceptance.

A case of this kind has occurred quite recently. Since van Wijhe's interesting and important observations on the mesoderm segments of the elasmobranchs, the view that the hypoglossal nerve has been derived by a separation of fibres from the ventral roots of the vagus has very generally been accepted. In a paper very shortly to appear in the 'Studies from the biological laboratory of the Johns Hopkins university,' an entirely different view will be supported.

From a comparative study of the origin and distribution of the anterior cervical nerves in the various orders of the class Pisces, I have been led to the conclusion that the post-occipital nerves, as they may be termed, of *Amia* and other ganoid forms, are comparable to the anterior cervical nerves of the elasmobranchs, and in the teleosts and maripobranchs have passed backwards, and become incorporated with the first spinal nerve. The apparent first spinal, therefore, represents three nerves. In the urodelous Amphibia, one finds, however, an arrangement more similar to what obtains in the elasmobranchs, there being in the anterior spinal region three distinct nerves, whose combined distribution resembles very closely that of the first spinal nerve of the teleosts, and may therefore be considered its equivalent. In the Anura there is a reduction in the number, the first nerve disappearing, or fusing with the second, so that two nerves here fulfil the function of the original three. In all these ichthyopsidan forms there is no true hypoglossal, this nerve making its appearance in the Sauropsida. From its distribution, it is apparently homologous with the three anterior spinal nerves of the urodelous Amphibia. As

a result of these comparisons, it may be concluded that the hypoglossal nerve of the Sauropsida and Mammalia is not a separation from the anterior roots of the vagus, but is formed by the coalescence of a number — probably three — of anterior spinal nerves.

Since the completion of my manuscript, the last number of the *Archiv für anatomie und physiologie* has been received; and therein is a paper by Professor Froriep of Tübingen, dealing, among other things, with this very point as to the origin and morphological relations of the hypoglossal. His observations were carried on by means of sections through very young sheep and cow embryos; and he was able to perceive that the hypoglossal at an early stage consisted of three distinct parts, which eventually unite; the union occurring first near the origin of the nerve, and proceeding centrifugally. To emphasize the similarity between Froriep's results based on embryological data, and my own deduced from anatomical facts, it will be well to quote a sentence from his paper. In summing up, he says, "The hypoglossus is formed by the union of a number of segmental spinal nerves, each of which is composed of two roots, — a ventral and a dorsal, — exactly like spinal nerves."

J. PLAYFAIR McMURRICH.

Johns Hopkins university, Baltimore, Md.

The Wisconsin bill relating to the instruction of deaf-mutes.

In *Science* (vol. v. p. 324) you state, that, until the present year, no special provision had been made in Wisconsin for the education of deaf-mutes. This is a mistake. The Wisconsin institution at Delavan, one of the best in the country, has been in successful operation since 1852, and two private schools are also in existence. The returns of the recent census, however, have shown that a large number of the deaf children of Wisconsin are growing up in ignorance, and that existing provisions for their instruction are inadequate. The bill that has just passed the Wisconsin legislature is an attempt to remedy the evil by a change in the policy of the state towards her deaf and dumb. The new plan may be tersely described as the policy of decentralization. The old policy of centralization — that is, the policy of collecting into one school all the deaf-mutes of a state — has everywhere failed to bring under instruction a large proportion of the deaf-mutes of school age. For example: there were in the United States in 1880, according to the last census, 15,059 deaf-mutes of school age (six to twenty years); while the total number of deaf-mutes returned as then in the institutions and schools of America was only 5,393, and many of these were beyond the school age. A similar result is obtained when we examine the statistics of each state taken separately.

Parents have a natural reluctance to part with their deaf children, who, more than others, require home care and attention. But education in an institution involves separation from home. Some parents will not part with their children excepting on compulsion; others delay the separation until the most impressionable period of life has been passed; and still others deprive their children of education on account of the value of their labor at home.

The nearer the school can be brought to the home of a deaf child, the less likelihood is there that he will escape instruction. The promoters of the Wisconsin bill believe that in many of the incorporated cities and villages of that state the deaf children

could, with limited state aid, be educated in the localities where they reside; and that, if day-schools were established wherever possible, the institution at Delavan would be able to accommodate all who could not attend a day-school.

The bill grants state aid to any incorporated city or village supporting a school for deaf-mutes, to the extent of a hundred dollars per annum for every pupil instructed. The state appropriation alone will probably be sufficient to provide a teacher for a school of four or five deaf children; but even a school containing only one deaf child, which, of course, would have to be supported mainly from local sources, may, by complying with the provisions of the bill, receive state aid to the amount of a hundred dollars per annum.

Under such a law, there should be no excuse for lack of instruction. Public opinion will probably compel the education of deaf-mutes: for, if allowed to grow up without instruction, they very easily become dangerous members of society; while, if educated, they become good citizens, amenable to the laws of society, and sources of wealth to the state. If only as a measure of economy, the Wisconsin bill demands consideration; for the average per capita cost of the education of a deaf child in an American institution exceeds two hundred and twenty-three dollars, whereas the cost to the state, on the Wisconsin plan, is limited to a hundred dollars.

But other considerations are of still greater importance. It certainly seems reasonable to expect that the Wisconsin plan, consisting of a central institution and a large number of small day-schools scattered throughout the state, will bring under instruction a larger percentage of the deaf children of school age than would be possible on the institution plan alone. Instruction can also be commenced in the day-schools at an earlier age than heretofore; so that many pupils could receive preparatory instruction in a day-school before entering the institution, and thus be enabled to receive from the institution a higher and better education than they could otherwise hope to obtain.

ALEXANDER GRAHAM BELL.

Washington, D.C., April 27.

A complete fibula in an adult living carinate-bird.

The only known bird with a complete fibula is the Jurassic Archaeopteryx (Marsh, Dames). The fibula of all birds is complete during the early life of the embryo. I find in an adult *Pandion carolinensis* of Prof. O. C. Marsh's collection an entire fibula, but with the distal end of it not in front of the tibia, as in Archaeopteryx (Marsh). It would be interesting to examine the embryos of this bird; and I will be very much obliged to anybody who can send me any of them.

DR. G. BAUR.

Yale-college museum, New Haven, Conn.,
April 24.

Digestion experiments.

I have read with some surprise the comments by Dr. E. Lewis Sturtevant in *Science*, April 24, upon my article on 'Errors in digestion experiments,' inasmuch as I had no intention, in that article, of asserting or implying any thing whatever in regard to other experiments of that character in this country. The purpose of the article was to call attention to the

rather large possible errors of the results of such experiments; and for that purpose I used the material nearest at hand. In order, however, to prevent any further misapprehension, I desire to say that I fully concede Dr. Sturtevant's claim to priority; although, owing to the fact that the bulletins of the New-York station are to be had at first hand only through the press of that state, I was not aware, at the time my results were first published (Bulletin No. 3 of the agricultural experiment-station of the University of Wisconsin, June, 1884), that he had anticipated me by three or four weeks.

I fully appreciate his remarks regarding the value of recognition, on the part of science, of scientific work at experiment-stations, and should regret exceedingly to seem to fail of doing whatever in me lies to secure such recognition. The field of agricultural science is too wide, and the workers in it far too few, to justify any professional jealousy.

H. P. ARMSBY.

Madison, Wis., April 30.

Tertiary phosphates in Alabama.

Since the publication of my two notes in *Science* last year, respecting the occurrence of phosphates in the cretaceous formation of this state, we have found that they occur also at at least two distinct horizons in the tertiary formation.

This formation in Alabama shows the following well-marked subdivisions, given in descending order:—

Vicksburg	175 (?) feet,	}	White limestone of Tuomey	}	Oligocene.
Jackson	60 "				
Claiborne	150 "	}	Claiborne,	{	Eocene.
Buhrstone	175-200 "				
Lignitic	1,000 "		Lignitic and flatwoods of Hilgard,		

The upper of these two divisions consists mainly of limestones, called throughout the country, and by Professor Tuomey, the 'white limestone.'

The lower division consists of sands and clays, which make up the greater proportion of the thousand feet or more of the strata of this group; but interstratified with these are five or six, and perhaps a greater number, of beds holding marine shells, the aggregate thickness of which may perhaps be given at a hundred feet.

Mr. D. W. Langdon, jun., of the state geological survey, while on a collecting tour for Mr. T. H. Aldrich, made the discoveries to which this note is intended to call attention.

At Nanafalia, on the Tombigbee River, there is a remarkable series of beds, over fifty feet in thickness, made up almost entirely of the shells of a small oyster (*Gryphaea thirsae*). At intervals throughout this thickness are projecting indurated ledges, holding the same shells, but forming a tolerably compact rock. A specimen from one of these hard ledges, one or two feet thick, has been analyzed by Mr. Langdon, and found to contain 6.7% of phosphoric acid. Other parts of the *Gryphaea* beds may be similarly phosphatic, but no analyses have yet been made to show it.

This Nanafalia marl, which occupies a position nearly in the centre of the lignitic subdivision, occurs

also on the Alabama River, at Gullette's and Black's Bluffs, and crops out between the two rivers in the lower part of Marengo county, where its presence is indicated by limy spots, or 'prairies,' of very great fertility. This marl contains also a very considerable percentage of greensand, and, apart from the phosphoric acid which it contains, would have become a valuable fertilizer.

The other phosphate-bearing horizon is in the lower or Jackson division of the white limestone.

At the base of the orbitoidal limestone which forms the greater part of the bluff at St. Stephen's, Mr. Langdon finds a hard ledge of rock holding *Plagiostoma dumosa*, and immediately beneath this, and extending fifteen feet down to the water's edge, a glauconitic marl holding numerous nodules or concretionary masses of phosphate of lime, — an occurrence quite similar to that of the nodules in the cretaceous beds at Hamburg in Perry county, described last year. Mr. Langdon's analysis of the greensand marl holding the nodules shows 0.6% of phosphoric acid, while a sample of the nodules analyzed contains 22.68% of phosphoric acid.

On the opposite side of the river, in Clarke county, similar materials have been collected and analyzed. A greenish glauconitic sand, occurring some three or four miles north of Coffeetown, contains 1.76% of phosphoric acid.

Fifteen or twenty feet above this marl, there is a yellowish-brown loam holding soft yellow nodular masses varying in size from one inch to eighteen inches in diameter, and containing 2.74% of phosphoric acid. This loam is probably formed by the disintegration of the Jackson limestone, the age of

the stratum being indicated by the specimen of *Plagiostoma dumosa* which it contains.

Again: near Grove Hill, in Clarke county, one of my students, Mr. S. S. Pugh, has collected a number of phosphatic nodules which contain 19.48% of phosphoric acid.

Where the argillaceous limestones of the Jackson age form the surface, they give rise, in their disintegration, to the rich limy or 'prairie' soils which characterize my 'Lime Hills' region,¹ which occurs over a good part of the counties of Choctaw, Washington, and Clarke. It is more than probable that the exceptional fertility of the soils of this region is in great measure due to the presence of these phosphates. In the upper part of the white limestone (Vicksburg), I have not yet been able to detect any unusual proportion of phosphoric acid.

In this connection it may be interesting to note that Mr. L. C. Johnson, of the U.S. geological survey, has traced the extension of the Alabama cretaceous phosphate beds into Mississippi, along the line pointed out by me in one of my notes above referred to. The occurrences in Mississippi are quite similar to those already described in this state.

EUGENE A. SMITH.

University of Alabama, April 20.

¹ Report on cotton-production in Alabama, p. 52.

PROGRESS OF THE LICK OBSERVATORY.

SOMETHING like a year ago, we reviewed the policy and operations of the Board of trustees of Mr. James Lick's bequest of about four millions of dollars for objects patriotic, charitable, and scientific, directing due attention to the conservative management of the estate, showing the utter folly of the attacks which have from time to time been made upon their official actions, and giving the best of reasons why all interested in the administration of this trust should uphold the board in the continuance of the policy which they have seen fit to adopt. The cessation of these impolitic hostilities is a matter of noteworthy significance, because of the relations of the bequest to the Lick observatory, and the other scientific objects which Mr. Lick thought worth gaining.

The trustees' first work — the construction of the great observatory on the summit of Mount Hamilton — has been prosecuted with such vigor during the past five years, that its completion at a definite epoch in the near future appears now to be a matter of certainty. It is only possible to say this because information has just been received from the glass-makers, Messrs. Feil and Mautois of Paris, that all serious difficulty in making the disk of crown-glass for the great telescope has at last been surmounted, — a difficulty which has already delayed the beginning of the opticians' work nearly three years, and has permitted the trustees to advance the remainder of the observatory to a finished state. The opticians now hope to be enabled to begin their labors upon this great object-glass by next August or September, and to complete their part of the contract within two years' time. This encouraging condition of affairs has been brought about largely by the recent action of the trustees themselves, who, desiring to complete as soon as possible their task of constructing and equipping the observatory, and finding that all further progress was conditional upon getting the necessary disk of glass, despatched a responsible agent to the eastern states, where he could be in consulta-

tion with prominent astronomers, and in ready communication with Paris.

The results of this action have been very satisfactory, and will enable the trustees to sketch the important outlines of their plans for future and final operations on the mountain. The fact that the glass is now to be obtained with reasonable certainty, has prepared the way for determining the size of the dome which will be required to cover the telescope when finally mounted. This building is already in process of erection, and will consume all the attention of the superintendent of construction for the next two seasons. The dome will have an interior diameter of seventy-three feet; and the telescope itself, whose exact length cannot yet be defined within narrow limits, will probably be fully sixty feet long, while, with the monster spectroscope attached, it may reach a length of nearly seventy feet from end to end.

Aside from this important end of securing the data necessary to avoid the entire cessation of work upon Mount Hamilton this summer, the agent of the trustees has also personally inspected the mountings of the great domes at Charlottesville, Washington, and Princeton, including the smaller ones at Harvard, Amherst, Columbia, and other colleges; and, on his return to San Francisco, he will report to the trustees on the information he has obtained, and recommend that plan for constructing and mounting the great dome which appears likely to insure in every way the best results. Any competent person who will take the trouble to consider the problem of building this dome from an astronomical and engineering point of view, will readily appreciate the nature of the obstacles to be overcome; but the eminently satisfactory arrangements devised, and already put into successful operation at this mountain observatory, will go a great way toward inspiring confidence in whatever form of dome the trustees finally decide to adopt. In an early issue, we shall place before our readers an account of the Lick observatory and its work, together with a fully illustrated description of the site, buildings, and instruments.

*COMPOSITE PORTRAITS OF MEMBERS
OF THE NATIONAL ACADEMY OF
SCIENCES.*

THOSE of the members who were present at the Washington meeting of the academy last spring will remember, that, at the request of Professor Brewer and myself, they sat for their separate photographed portraits for the purpose of obtaining an experimental composite picture. Professor Baird kindly offered the facilities of the photographic department; and the pictures taken by Mr. Smilie, the photographer in charge, bear the same stamp of excellence that characterizes so generally the work of that department of the national museum.

As only one or two previous attempts, I believe, have been made to produce composites in this country, I will state briefly what they are, and how they are made.

The idea in its broadest sense was conceived and applied by Francis Galton for the purpose of obtaining an average or type portrait; i.e., a picture that should show the features that are common to a group of individuals, and exclude those that are purely individual. It is clear, that, in proportion as this result is attainable, the method will be of value in obtaining a clear conception of the external characteristics of any given type or class.

Galton reminds us, that, during the first days of a traveller's meeting with a very different race, he finds it impossible to distinguish one from another, without making a special effort to do so: to him the whole race looks alike, excepting distinctions of age and sex. The reason of this is, that, by short contacts with many individuals, he receives upon his retina, and has recorded upon his memory, a composite picture emphasizing only what is common to the race, and omitting the individualities. This also explains the common fact that resemblances among members of a family are more patent to strangers than to the relatives.

The individuals entering into these composites were all photographed in the same position. Two points were marked on the ground glass of the camera; and the instrument was moved at each sitting to make the eyes of the sitter exactly coincident with these points. The composites were made by my assistant, Mr. B. T. Putnam, who introduced the negatives successively into an apparatus carefully constructed by himself, and essentially like that designed by Mr. Galton, where they were photographed by transmitted light. The arrangements of the conditions of light, etc., were such that an aggregate exposure of sixty-

two seconds would be sufficient to take a good picture. What was wanted, however, was not an impression of one portrait on the plate, but of all the thirty-one; and to do this required that the aggregate exposure of all the thirty-one should be sixty-two seconds, or only two seconds for each. Now, an exposure of two seconds is, under the adopted conditions, too short to produce a perceptible effect. It results from this, that only those features or lines that are common to all are perfectly given, and that what is common to a small number is only faintly given, while individualities are imperceptible. The greater the physical resemblances among the individuals, the better will be the composites. A composite of a family or of near relatives, where there is an underlying sameness of features, gives a very sharp and individual-looking picture.

It would be difficult to find thirty-one intelligent men more diverse among themselves as regards facial likeness than the academicians entering into this composite. They are a group selected as a type of the higher American intelligence in the field of abstract science, all but one or two being of American birth, and nearly all being of American ancestry for several generations. The faces give to me an idea of perfect equilibrium, of marked intelligence, and, what must be inseparable from the latter in a scientific investigator, of imaginativeness. The expression of absolute repose is doubtless due to the complete neutrality of the portraits.

Fig. 3 contains eighteen naturalists and thirteen mathematicians, whose average age is about 52 years. Fig. 1 contains twelve mathematicians, including both astronomers and physicists, whose average age is about 51½ years. Fig. 2 is a composite of sixteen naturalists, including seven biologists, three chemists, and six geologists, with an average age of about 52½ years.

I may mention, as perhaps only a remarkable coincidence, that the positives of the mathematicians, and also of the thirty-one academicians, suggested to me at once forcibly the face of a member of the academy who belongs to a family of mathematicians, but who happened not to be among the sitters for the composite. In the prints this resemblance is less strong, but in these it was observed quite independently by many members of the academy. So, also, in the positive of the naturalists, the face suggested, also quite independently to myself and many others, was that of a very eminent naturalist, deceased several years before the sitting for this composite.

There is given also a composite (fig. 4) of

a differently selected group. It is of twenty-six members of the corps of the Northern transcontinental survey, — an organization of which I had charge, and the object of which was an economic survey of the north-western territories. It was a corps of men carefully selected as thoroughly trained in their respective departments of applied geology, topography, and chemistry, and having the physique and energy, as well as intelligence, needed to execute such a task in face of many obstacles. The average age of this group was thirty years. RAPHAEL PUMPELY.

*MORTALITY EXPERIENCE OF THE
CONNECTICUT MUTUAL LIFE-IN-
SURANCE COMPANY.*

THERE is a popular superstition, almost universal among our transatlantic cousins, and widely spread in our own country, that Americans are shortening their days by hard work, and inattention to the laws of healthy living. Our readers may remember, that, when Mr. Herbert Spencer first arrived in this country, he immediately began lecturing us on this subject. No surer test of this question can be found than that of mortality statistics, because those who insure their lives belong principally to the very class, who, according to the superstition, are most actively engaged in their own extermination. The tables recently published under the above title are therefore of great interest. The fulness of detail, and variety of form, in which the results are presented, facilitate their discussion. It therefore seems worth while to point out the most interesting results obtained. The fact thus brought out is, that at the very ages when mortality from over-work should most powerfully show itself, namely, from thirty to sixty, the American mortality is more than one-third less than the English, as shown by the combined experience table, and is constantly diminishing.

There are, however, reasons why we should not expect the death-rate shown by the experience of a life-insurance company to coincide with the rate amongst the community at large. Insured lives are not taken at random from the community, but form a select body. Only a limited class possess the foresight and interest in the future which would induce them to insure their lives. Out of that limited class, the insurance company selects only those whose viability is free from serious doubt. This selection, of course, tends to result in the insured class having better lives than the com-

munity at large. There is, however, a tendency in the opposite direction, which may be operative to a limited extent. A person who has reason to suspect his viability will have a stronger motive to get insured than one who does not. There is, however, no evidence that this cause has resulted in the lowering of the standard among the insured generally.

One result of the selection exercised by the company is obvious, and has frequently been pointed out by writers on the subject. Out of the class of men with good constitutions, the company selects only those who are, for the time being, in good health. With those who are going to die, symptoms of disease frequently appear weeks, months, or even years before actual death. The probability of a healthy person dying within the year following his examination by the life-insurance company is therefore less than the probability that he will die in the second year; and this, again, is still less than the probability that he will die in the third year. It has commonly been supposed that three years would have to elapse after the examination, before the probability reached its normal point. It is remarkable that the table now before us exhibits this effect in a much smaller degree than usual. The death-rate during the first two years of insurance is less by perhaps ten per cent than the general rate at all ages. During the third year it is actually less than during the second. Instead of attaining its maximum at the end of the third year, it continues to increase, and it does not reach the regular curve until the sixth year. It would seem that while the company gains a certain advantage during the first five years, through its privilege of selection, that advantage is far less during the first year than would have been supposed, and far less than common experience has hitherto shown it to be.

Another remarkable result, which we wish had been explained more fully, is the extraordinary death-rate among the younger class. This is more strongly shown among natives of the United States than among the insured at large. From the age of twenty-one to ninety, the death-rate follows the table of mortality very closely, but is uniformly from fifteen to twenty per-cent less than the tabular rate. But among native Americans, between the ages of seven and twenty, the rate is forty per cent greater than that given by the American table. The actual number of those who died was forty-seven, while the table gives only thirty-three deaths. The case is rendered yet more striking by the consideration that the mortality of the American table at the early ages is greater

than that of the combined experience table of the English companies. Above the age of thirty, the American mortality is decidedly less than the English, while at the earlier ages it is greater. The American table shows a maximum of advantage over the English experience about the age of fifty. The deaths at this age are about one in seventy-three by the American table, while the English table gives one death in sixty at this age. The experience before us greatly increases this discrepancy on the two sides of the Atlantic. At the age of fifty, the Connecticut company has only one death in ninety-three, against the numbers just stated for the English and American tables respectively. Perhaps the case is seen in the strongest light by remarking that the actual mortality at the ages from thirteen to twenty has been appreciably the same as at the ages from forty-six to fifty. Whether this extraordinary mortality is due to some special cause, is not clearly stated. If the lives which have been accepted by the company are representative ones of their class, it would seem that young Americans are subject to some extraordinary liability to death.

The insured are divided into forty-nine classes of occupations. It will perhaps sadden the reader to learn that travelling-agents, among whom book-agents are undoubtedly classed, seem to have the greatest viability of all. Taking them and lumber-men together, the death-rate is less than half that given by the tables. Dentists come third, and meet with the same fortunes as professors and teachers: for both classes the mortality is six-tenths that of the tables. How little mere occupation has to do with viability, is shown by the fact, that, while bankers and capitalists suffer one-fourth less, brokers, speculators, and operators suffer twelve per cent more than the tabular mortality. Officers of the navy, and of ocean and sailing vessels, have suffered the greatest comparative mortality of all, having died twice as fast as the general average of the insured. This is no doubt to be attributed to the civil war, which occurred during the time covered by the experience. Taking out this case as exceptional, the greatest mortality of all would be found amongst liquor refiners and dealers, bar-keepers, landlords, etc. This is quite in accord with general experience.

It is much to be desired that the mortality statistics of the census should be placed on a better basis. If the census office were to be made a permanent one, we might expect such a result to be attainable. S. NEWCOMB.

AMERICAN FLASH LANGUAGE IN 1798.

THE cant or flash language, or thieves' jargon, was scarcely known, even by name, in the United States, until attention was drawn to it some forty years ago by the publication of Ainsworth's 'Rookwood' and 'Jack Sheppard,' followed by Dickens's 'Oliver Twist.' Even then it was regarded as a purely English product; and it was not until 1859 that Mr. G. W. Matsell, chief of police in New-York City, published a little work upon this dialect, showing that it had been to some extent transplanted to this side of the Atlantic. I am not aware that any mention has ever been made of the fact that there exists a full glossary of this thieves' jargon, as spoken nearly a century ago at the Castle in Boston harbor (now Fort Independence), which was used down to the year 1798 as a state penitentiary. The reason for this neglect lies, no doubt, in the fact that the book in which this glossary is given — 'The life and adventures of Henry Tufts' (Dover, N.H., 1807) — is an exceedingly rare one, having been, it is said, suppressed by the author's sons. It is not to be found in any public library in Cambridge or Boston; and the only copy I have ever seen was picked up by myself at an old book-store, many years since, and was presented to the Worcester, Mass., city library. In a paper to be published elsewhere, I have given some account of this singular book; but this glossary of terms deserves a separate treatment as a contribution toward the history of the American speech. There is nothing more curious than the vitality of a class of words never employed in good society, and never admitted into any dictionary. While we all claim theoretically that vocabularies, and even academies, are necessary for the preservation of a language, we yet find in practice that these base-born brats, these children of thieves and outcasts, have a vitality of their own. The profane or indecent phrases which boys hear at school, and which they repeat with bated breath if at all — these same words were heard at school by their grandfathers, and have led a hardy and disreputable existence ever since; yet they remain unchanged, and time has not, as Sir Charles Pomander said of his broken statues, 'impaired their indelicacy.' Tufts's list does not, for a wonder, stray into the domain of impropriety, though the rest of his book does; but he gives many words that can be traced through other similar dictionaries, many that occur in his glossary alone, and others that are now familiar, and are commonly supposed to be recent. I have ref

arranged his glossary in alphabetical form, and have in a few cases analyzed a phrase into its component words; but I have not altered his definitions. In the table that follows, his list of words will be found compared with various other lists of the same description.

The books which I have selected for comparison were published at various dates, some before and some after Tufts's glossary, which was compiled at least as early as 1798, he having been a prisoner at the Castle for the five years preceding. These books are as follows, arranged in order of date, and they are designated in the accompanying table by this date alone.

1573, Harman's (Thomas) 'Caveat for common cursetors,' reprinted in J. C. Hotten's 'Slang dictionary,' ed. 1873, p. 15.

1673, Head's (Richard) 'Canting academy, to which is added a compleat Canting Dictionary.'

1785, Grose's (Francis) 'Classical dictionary of the vulgar tongue.'

1790, Potter's (Henry T.) 'New dictionary of the cant and flash languages.'

1811, 'Lexicon Balatronicum' [founded on Grose].

1859, Matsell's (George W.) 'Dictionary of the thieves' jargon' [New York].

1873, Hotten's 'Slang dictionary,' a new edition.

Tufts's glossary, 1793-98 (Boston).

Blower	A woman	1673 (<i>blower</i>); 1785 (same); 1790; 1811; 1873.
Bonny lay	Highway robbery	[The best <i>lay</i> , or device.]
Briar	A saw	[Obvious analogy.]
Chant	Writing of any kind	1790 (<i>chant</i> , to make known); 1859 (same, and also <i>chant</i> = name).
Clout	A handkerchief	1859; 1873 (called 'old cant').
Cly	A pocket	1573; 1785; 1790; 1811; 1859; 1873 [Anglo-Saxon <i>clea</i> , claws?].
Cove	A man	1573 (<i>cofe</i>); 1673; 1785 (<i>cove</i> or <i>coffin</i>); 1790 (landlord); 1811; 1859 [found in Dekker's 'Wits' recreations']. 1785 (<i>crab-shells</i> , Irish); 1811 (same); 1859 (same, and also <i>crabs</i> = feet); 1873.
Crab	A shoe	1785 (<i>crab-shells</i> , Irish); 1811 (same); 1859 (same, and also <i>crabs</i> = feet); 1873.
Crabkin	A shoemaker's shop	1785; 1790; 1811; 1859; 1873.
Crack	To break open	1785; 1790; 1811; 1859; 1873.
Darky	Cloudy	1573 (<i>darkemans</i> = the night); 1673, 1785, 1790, 1811 (the same); 1873 (<i>darky</i> = twilight).
Dead up to, to be	To know well	[<i>Dead</i> = very, exceeding. Halliwell, North.]
Dinge	A dark night	[To <i>dinge</i> = to drizzle. Halliwell.]
Dingy cove	A negro	1785 (<i>dinky Christian</i> = a mulatto); 1811 (same).
Do	To rob	1785; 1811; 1873.
Douse the glim	To put out the light	1811; 1859; 1873 [<i>glin</i> or <i>glim</i>].
Drag	A prisoner	[One <i>dragged</i> by the police?]
Dub	A false key	1785; 1790 (<i>dubb the jigger</i> = lock the door); 1811; 1859.
Evening sneak	Going into a house at night, where the doors are open,	1785; 1790; 1811.
Flamer	Vitriol	[Inflamer?]
Flat	A foolish man	1785; 1790; 1811; 1859; 1873.
Gentleman	A crowbar	1785; 1790; 1811; 1859; 1873.
Glaze	A square of glass	1785 (<i>glaster</i> = a window-thief); 1811; 1859; 1873.
Glin	A star or light	1573 (<i>glimmar</i> = fire); 1673, 1790 (the same); 1811 (<i>glim</i>); 1859 (<i>glimsticks</i> = candlesticks); 1873 (<i>glim</i>).
Gorge	A person or fellow	1811 (<i>gorger</i> = a gentleman). [Gypsy, <i>gorgio</i> .]
Grub	Victuals	1785; 1790; 1811.
Hammers to you, I'm,	I know what you mean.	
Hookses	Neat-cattle	
Horney	A sheriff	1790 (<i>hornees</i>); 1859 (<i>horness</i> = watchman).
Jarvel	A jacket	
Jigger	A door	1573 (<i>gyger</i>); 1790; 1811 (<i>jig</i>); 1859; 1873.
Kickses	Breeches	1785 (<i>kicks</i>); 1790, 1811 (<i>kicks</i> or <i>kickseys</i>); 1859 (<i>kicksies</i>); 1873 (same).
Kin	A stone	
Kinchen	A child	1573 (<i>kynchen</i>); 1673; 1785; 1790; 1811; 1859; 1873. [German, <i>kindchen</i> .]
Lay	[Mode of stealing]	1785; 1811; 1859; 1873.
Leg-bags	Stockings	[<i>Bags</i> = trousers, London <i>Punch</i> .]
Long tog	A coat	[<i>Toga</i> , Shakspeare, <i>Togde</i> .]
Lour	Money	1573 (<i>Lovere</i> , a Wallachian gypsy word); 1673; 1785; 1790 (<i>lour</i> or <i>lower</i>); 1811; 1859 (<i>lowre</i>); 1873.
Mitre	A hat	
Napping	Stealing	1673; 1785; 1790; 1811; 1859; 1873.
Napping his bib	Crying	1790; 1873.
Nipping-jig	A gallows	1673 (<i>nubbing cheat</i>).
Oliver	The moon	1790; 1859; 1873 ('nearly obsolete').
Petre yourself	Take care of yourself	1790 (<i>peterees</i> = thieves of <i>peters</i> or trunks); 1859 (<i>peter-biter</i> = same).
Pops	Pistols	1785; 1790; 1811; 1859; 1873.
Prad	A horse	1573 (<i>prauncer</i>); 1673 (<i>prancer</i>); 1790; 1811; 1859; 1873 ('old cant').
Pradholder	A bride	
Qua	A jail	1573 (<i>quyer ken</i>); 1673 (<i>queer ken</i>); 1790 (<i>quod</i>); 1873 (<i>quad</i> or <i>quod</i> , an abbreviation of quadrangle).
Quakeeper	A jailer	
Quid	A guinea	1790; 1859 (<i>quid</i> = \$5).
Quillpipes	Boots	1785 (<i>quillpipe boots</i> , so called because plaited like a quillpipe); 1811 (same).
Quisby	Mean	1785 (<i>quis</i> = a strange-looking fellow); 1873 (<i>quisby</i> = an amplification of <i>queer</i>).
Roram	The sun	[Possibly a corruption of Rowland, to correspond to <i>Oliver</i> = the moon.]
Rum-blower	A gentlewoman	1785 (a handsome wench); 1790 (same); 1811 (same); 1859 (same).
Rum-cove	A gentleman	1785 (a dexterous rogue!); 1790 (a good landlord); 1811 (same as 1785).
Scrag a lay, to	To steal clothes from a hedge	

Slangs	Irons	1790 (<i>slanged</i> = ironed); 1811; 1859 (<i>slanged</i> ; also <i>slang</i> = watch-chain); 1873 (only a watch-chain).
Smish	A shirt	1573 (<i>mish</i> or <i>commission</i>); 1790 (<i>mish</i> or <i>smeesh</i>); 1811 (same as 1785); 1859 (<i>mish</i>); 1873 (both <i>mish</i> and <i>smish</i>).
Snuskin	A nail	[<i>Snuskin</i> = a delicate morceau. Halliwell.]
Spotted, you're . . .	You are like to be found out,	1859 (<i>spot</i> = point out as suspected); 1873 (marked by the police). [Mentioned as 'recent' in Bartlett's 'Americanisms.']
Spread	A saddle.	
Star a glaze, to . . .	To cut out a pane	1811; 1859; 1873.
Suck	Rum [liquor]	1785; 1790; 1811; 1859; 1873 (only <i>suck-casa</i> = a public-house).
Tapster	A dog	[Probably a mere variation of <i>Yapster</i> .]
Thumpkin	A barn of hay	[<i>Thumpkin</i> = a clown. Halliwell.]
Topt	Hanged	1673, 1785 (<i>topping cove</i> = the hangman); 1790; 1811; 1859; 1873.
Tonch, to	To rob	1785; 1790; 1811; 1859.
Trick	A watch	1859 (<i>trick</i> = any thing stolen by a pickpocket).
Undub, to	To unlock	1859 (<i>under-dubber</i> = turnkey).
Water-sneak	Breaking into a vessel	1785 (<i>waterpad</i> = robber of ships); 1790 (same).
Wheel	A dollar.	
Wibble	An anger	1785 (<i>wibble</i> = bad drink); 1811 (same); 1859 (same). [<i>Wimble</i> = an auger. Dryden.]
Yapster	A dog	[<i>Yap</i> = a cur. Halliwell.]

[When a date alone is given in the above table, the dictionary of that date gives both word and definition as Tufts gives them.]

It will be observed that a certain number of Tufts's words are not to be found in any of the books of English slang; while, from the correctness of the remainder, it is unlikely that he invented even these. The words *bcnny lay* (robbery), *briar* (a saw), *drag* (a prisoner, i.e., one dragged?), *flamer* (vitriol), *gentleman* (a crowbar), *hammers to you* (implying comprehension), *hookses* (cattle), *jarvel* (a jacket), *kin* (a stone), *nipping-jig* (gallows), *roram* (the sun), *to scrag a lay* (to steal from a hedge), *snuskin* (a nail), *spread* (a saddle), *tapster* and *yapster* (a dog), *thumpkin* (a barn of hay), and *wheel* (a dollar), — these are not found in the other lists, and some of them are difficult to explain. Other phrases, though not elsewhere mentioned, are easy of derivation; as *crabkin* (crabken?), *dead up to* (like dead sure), *dinge* (dingy), *leg-bags* (stockings), *long togs* (long-clothes), *mitre* (hat), and *pradholder* (bridle). In a few cases the phrase is preserved by Mattsell (1859) as a part of American slang, although not now to be found in the English slang dictionaries; thus, *trick*, in the sense of something stolen, and *undub* (unlock), which apparently survives here in the phrase *under-dubber* (turnkey). In regard to any word untraced, I should be glad of suggestions.

T. W. HIGGINSON.

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WALKING AND RUNNING.¹

ALTHOUGH every one pretends to know how to walk and run, still there are few who do not make

useless effort; and the few good runners or walkers are not necessarily those with great muscular force, or power to withstand fatigue, or those who have merely a special aptitude in this direction, but rather the persons who by training have found, little by little, the best possible means of using their natural powers. They are incapable of transmitting the secret of their ability, and, indeed, they hardly have time to reflect upon the movements which they execute so mechanically. It is hoped that by means of the camera this secret can be found.

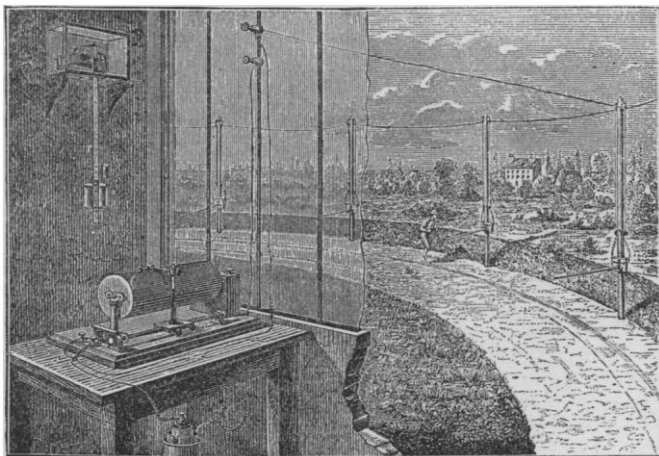


FIG. 1.

Experiments have been undertaken at the physiological station in Paris to study these movements. In fig. 1 a man is seen running upon the experiment-track, and in the same figure the recording apparatus is shown. A telegraph-line, resting upon poles placed fifty metres apart, reaches around the track, which is half a kilometre in circumference. The runner, as he passes each post, finds his course barred by a horizontal rod (fig. 2), which gives way before the slightest pressure, but which cannot be moved without causing an interruption in the circuit of the telegraph-line. This interruption records itself in the laboratory

¹ Abridged from *La Nature*.

by displacing a crayon, which traces upon a turning cylinder covered with a sheet of paper.

The mechanism of the electric interrupter is very simple, as shown in fig. 3. The rod which bars the

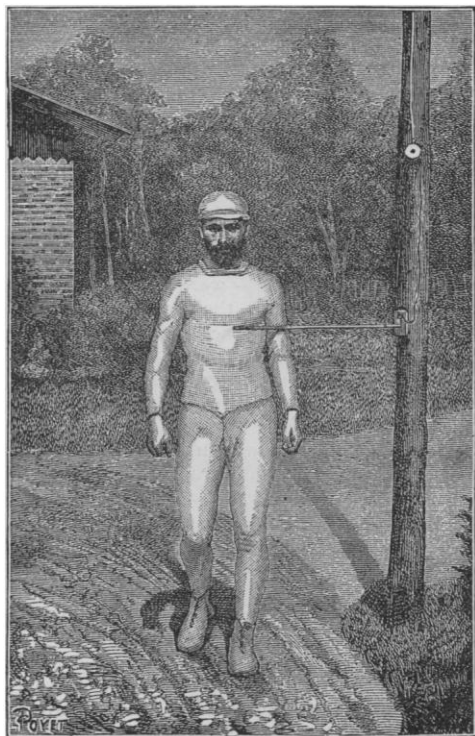


FIG. 2.

track is so arranged that it slides up an inclined plane every time it is displaced, and in so doing presses upon a spring, which, displacing a button of metal, breaks the circuit. The rod immediately returns to its original position, and the interrupted current re-establishes itself. At each breaking of the current, the wheel-work of the recording apparatus, freed for a moment, moves, and makes the crayon advance on the paper. The paper-covered cylinder turns uniformly, the rate of rotation being such as to cause the paper to pass in front of the crayon at the rate of half a centimetre per minute. On the other hand, the crayon is allowed to move only when the current is interrupted. The crayon progresses at each rupture of the current only a constant distance.

After a person has travelled around the track, the paper bears a sinuous line similar to that in (a), fig. 4. In the diagram the time is scored horizontally, the minute spaces equalling half a centimetre. The interruptions score themselves vertically, each upward step showing that the pedestrian has gone fifty metres: hence the course (a) corresponds to a march of twelve hundred metres in fifteen minutes,

thirty-five seconds. In drawing a line connecting the angles of the sinuous line, we have a simpler expression of the march, as seen in the lines *b*, *c*, *d*, etc., which, by their greater or less inclination, show that the gait has been more or less rapid. The line (*i*), for instance, corresponds to a run of sixteen hundred metres in nine minutes and a half, while (*c*) corresponds to a march of seven hundred and fifty metres in sixteen minutes.

By gathering outlines from hours of marching, we have much more interesting records, in which the effects of fatigue are plainly seen, all irregularities in speed being faithfully recorded by the rise or fall of the line.

The shape of the boot has considerable effect upon the quickness of the march. In order to determine the best form of marching-boots, buskins have been made with heels which can be regulated, by removing plates, so as to be of any height from half a centimetre to six centimetres. From the experiments it is seen that the quickness of the step increases in proportion to decrease in height of heel. This result tends to an increase in the length of the step, and it is also noticed that the step increases in length and quickness when the length of the sole considerably exceeds that of the foot. Beyond a certain limit, however, the precise determination of which can only be made after many experiments, the length of the sole causes a noticeable fatigue.

The rhythm of the drum or clarion guiding the steps of soldiers has marked effect upon their speed. This problem is very complex. The acceleration of the rhythm may increase the speed to the rate of eighty steps per minute; but beyond this the increased frequency of the steps causes a slackening in the rate of march. In order to experiment upon this, an electric bell, placed in the centre of the track, is rung by a pendulum, represented above and to the left in fig. 1. The rate of ringing can be regulated, and the walker finds it impossible to keep out of step with the strokes of the bell. Starting the bell so as to cause the man to take forty steps per minute, then gradually making it more rapid, it is seen that the

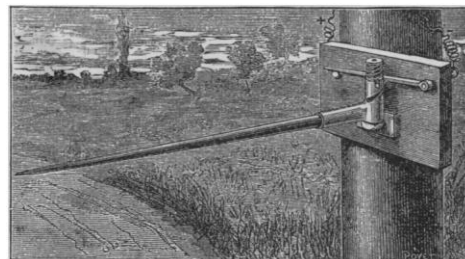


FIG. 3.

time taken to run a kilometre varies greatly. The length of the steps is simply deducted from the number of oscillations of the pendulum during a tour of the track, which represents a well-known course.

Experiments show that the progressive acceleration of the rhythm brings about the modifications represented in the following table. The acceleration of rhythm from sixty to eighty steps per minute has

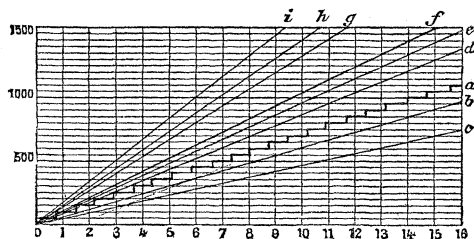


FIG. 4.

increased the length of the step, and decreased the time required to travel a certain distance; but, when we go above this, the opposite effect is produced. It is better to replace the numerical table by the diagram of fig. 5, which represents the variations in

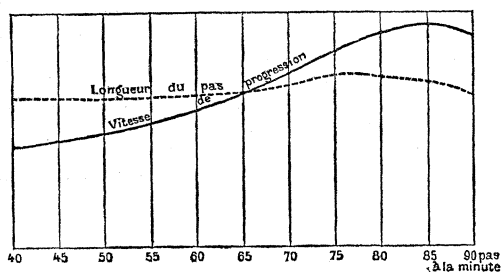


FIG. 5.

quickness of gait, and length of steps, as guided by the electric bell ringing at different rates.

Time of travelling over 1,542 metres.	Number of double steps to the minute.	Length of double steps.
20' 30"	60	1.35 m.
18' 40"	65	1.37 m.
16' 27"	70	1.45 m.
14' 58"	75	1.51 m.
13' 52"	80	1.50 m.
13' 3"	85	1.49 m.
14' 1"	90	1.32 m.

NAVAL ARCHITECTURE IN ENGLAND.

FRANCIS ELGAR, professor of naval architecture, at the University of Glasgow, devoted his inaugural address, on entering upon his duties in November, 1884, to a history of the science.

Until within comparatively few years but little attention has been paid to the study of naval architecture. Fifty years ago ninety-nine per cent of the British merchant-ships were under five hundred tons, and few measured more than a hundred and thirty

feet. They were comparatively uniform; and, being built after an established plan, they were perfectly seaworthy when properly ballasted. In the case of war-ships the matter was more difficult; as it was necessary to get a type of ship which should be large, high out of water, and able to carry many large guns, without interfering with her sailing-qualities, or rendering her top-heavy.

In 1811 a school of naval architecture was started in England, and during twenty years it trained forty students. This was followed in 1848 by another at Portsmouth, and in 1864 by a third at South Kensington, which is now united with the Royal naval college at Greenwich. Some excellent designers have been graduated from these three schools.

Before the use of iron, ship-building required no elaborate calculations: it was simply a highly developed mechanical art. Ships were built of great relative depths in proportion to their breadth, and initial stability was deliberately sacrificed to reduce the tonnage measurement. Usually these ships would not stand up, when fully rigged and light, without ballast; and, judging from the proportions given to them, they must also have required ballast when laden with cargoes which were not composed of heavy dead-weight. What is now required of the ship-builder is to predict with great accuracy the weights of complicated iron and steel structures, with all their fittings and machinery; the weight of cargo that such structures will carry at sea; the stability they will possess in different conditions of loading, and the treatment necessary to insure a safe amount of stability being preserved upon all occasions; the amount of steam-power and the rate of coal-consumption required to maintain given speeds at sea; and very frequently the strength that is possessed by the hull to resist the straining-action of waves.

The reason that the English schools for this study have not been better attended, is that the courses are too technical in character, and the requirements too rigid, to attract any except advanced students. The idea of the newly established chair of naval architecture in the University of Glasgow is to teach in a less technical manner the new science, and to adapt the course to the requirements of the students. The policy will be first to fix what they already know, and then to go forward to a complete study. Special stress is to be laid upon long-continued and arduous practical training, combined with true science. The only way in which superiority in ship-building can be attained is by possessing a class of ship-builders who have gone through just such a training, and who by long study and work have acquired these theoretical and practical principles.

RECENT BRITISH LOCOMOTIVES.

ENGINES recently designed for the London, Brighton, and south-coast railway of Great Britain by Mr. Stroudley, were described by their designer at a recent meeting of the British institution of civil engineers. They were designed for freight-traffic, or as

goods-engines.' The steam-cylinders were inside the frames. The forward wheels were coupled, instead of, as usual, the after-wheels; thus getting a set of small trailing-wheels, short outside coupling-rods, and a large boiler. The centre of gravity of the engine was purposely made high, as is the practice in this country in the construction of the wide-firebox engines of Mr. Wooten, for the purpose of making the engine move more easily at high speeds, and, as both these designers believe, making them safer; the rolling being less serious at exceptionally high speeds than in engines having a low centre of gravity. The action of the high centre of gravity in throwing the pressure mainly upon the outer rail, in rounding curves, was thought to be another advantage of appreciable value, permitting the inside wheels to slip more readily. Six wheels were used, without truck or 'bogies.'

It was asserted that the cranked axle, and other parts of the machine, do not break if properly proportioned, although it was evidently felt that the axle is a source of danger in greater degree than when straight, as in outside-connected engines. The steam was given an admission varying from twelve to seventy-eight per cent, the engine running very smoothly, and with great economy, at high speeds, with the shorter cut-off. The compression is thus made advantageous in both ways. It was considered that compounding would not be of sufficient advantage to justify its adoption in such engines; although it might prove useful for heavy, slow-moving engines, working with little expansion the greater part of the time. The Westinghouse brake was fitted to all these engines, and gave thorough satisfaction. Its pump had been fitted with a water-connection, and it could thus be utilized as a boiler-feeder when on sidings. The boiler was made of Yorkshire iron, with joints butted, edges of sheets planed, holes drilled after bending the sheets, and all hand-riveted. The steam used amounted to about twenty-six pounds per horsepower per hour, on a road on which the average is thirty. One pound of coal conveyed one ton thirteen miles and a half, at the speed of 43.38 miles an hour. Heating the feed-water saved two pounds and a half per train-mile.

SEMI-CENTENNIAL OF THE LYCEUM OF NATURAL HISTORY AT WILLIAMS COLLEGE.

It will be news to many, that a natural history society of college students has had an uninterrupted existence of fifty years at Williams college, in the little village of Williamstown, Mass. It is nevertheless true, and its semi-centennial was celebrated on April 24.

The exercises were opened by the president of the society, Mr. Henry B. Ward, with a short historical sketch. "Fifty years ago," said he, "on the 2d of April, eight students of Williams college formed a society for the study of natural history in its various departments. At first secret, under the name of $\Phi_B\Theta$, within six months it adopted its present

name. Professor Albert Hopkins, speaking twenty years later, said that it had sustained from the beginning a spirit of enterprise. The history of its early years remarkably verifies his assertion; for within a year from its formation it was large and active enough to send to Nova Scotia an expedition of twelve members and three professors. This expedition gave the lyceum a considerable reputation, and it was referred to by a French scientific journal as the first of the kind attempted in America. In the spring of 1840, only four years later, an expedition was sent through Berkshire county for study and collecting. By these two expeditions and individual effort, the collections well filled the society's rooms in East college. When that building was destroyed by fire, in 1841, the collections also perished. Contributions from all sides, and hard work by the members, soon restored them so well that the rooms in South college became too small; and in December, 1854 a circular was sent out, forcibly setting forth the needs of the lyceum, and asking for twenty-five hundred dollars to erect a building. This circular was brought to the notice of Mr. Nathan Jackson of New York, a relative of Col. Williams, and grand-uncle of the president of the lyceum at that time. He sent a check for the whole amount; and in a few months Jackson hall was completed. At commencement, Aug. 14, 1855, the lyceum was addressed in the forenoon by Prof. William B. Rogers, and in the afternoon held a public meeting in its new rooms in Jackson hall, to dedicate the building, and celebrate its twentieth anniversary. At this time Mr. Jackson sent a thousand dollars to make up the full cost of the building. In February, 1857, desiring to fill the cases in Jackson hall, the lyceum sent an expedition to Florida. Sixteen members, under the guidance of Professor Chadbourne, spent a month collecting on the Florida shores, with great success. The expenses were provided for by the liberality of Mr. Jackson and other friends of the society. In 1860 another expedition under the charge of Professor Chadbourne was arranged to Labrador and Greenland, a description of which has been recently published by Prof. A. S. Packard, a guest of the lyceum on that trip. In 1867 an expedition under the joint auspices of the lyceum and the college was sent to South America, under the charge of Professor James Orton, a former president of the lyceum. A small party proceeded from the northern coast by the courses of the Orinoco and Rio Negro to the Amazon: the main body crossed the Andes from the western coast, and descended the Amazon in canoes. In 1870 an expedition from both the lyceum and college spent four months collecting in Central America with great success. The expedition of 1877 to the northern Rocky Mountains was broken up by the death of Professor Tenney, its leader, just as it had started.

"Many have been the professors who have aided the lyceum in its work; but to Professor Albert Hopkins, Dr. Chadbourne, and Professor Tenney it owes a debt of gratitude which can never be computed."

Dr. W. K. Brooks, a former president, then addressed the lyceum on Life. He spoke of the age

of biology, the study of life, and said that modern biological study began with Darwin's visit to the Galapagos Islands fifty years ago. "Activity of protoplasm cannot be called life. Vital phenomena are distinguished by what is done, not by the constituents of the organism. There is no necessary connection between life and protoplasm. The common characteristic in all life is education. Life is education, and education is life. Kick a stone and a dog; the difference in the result is caused by education." He then referred to examples of natural difference in life as caused by education, and adjustment by education to varied circumstances. "The common characteristic in all these forms of life, from the highest to the lowest, is education. If, then, life is education, in seeking the latter we are advancing the former."

At the close of the lecture, Dr. Brooks was tendered a reception by the lyceum, at its building, Jackson hall, where letters and speeches from old members showed that their interest was still great.

The lyceum is the only active college society in this country which has its own building. It has now about twenty working-members, and holds its meetings every week, at which reports are given by members appointed in advance, on the subject which they are studying. Since Dr. S. F. Clarke took the professorship of natural history in the college, a strong interest in biology has been aroused in the society.

Among the members who have devoted themselves to science after graduation, the following are the best known: Professor Addison Ballard, '42; Mr. William H. Edwards, '42; Prof. W. D. Whitney, '45; Hon. D. A. Wells, '47; Dr. P. A. Chadbourne, '48; Dr. William Goodell, '51; Prof. Henry A. Ward, '55; Professor James Orton, '55; Mr. Samuel H. Scudder, '57; Dr. R. H. Ward, '58; Dr. E. W. Morley, '60; Prof. F. H. Snow, '62; Dr. G. Stanley Hall, '67; Dr. W. K. Brooks, '70; Dr. E. A. Birge, '73; and Mr. J. S. Kingsley, '75.

THE UNITED STATES AT THE FISHERIES EXHIBITION.

It is impossible to do much more than indicate the contents of this immense volume of over thirteen hundred pages. It is entitled 'Descriptive catalogues;' but, as observed by Mr. Goode, it really partakes of the character of a report on the part played by the United-States exhibit at the London fisheries exhibition, — not only that of the government, but also that due to private American exhibitors. A considerable part of the volume was printed, and distributed to visitors, during the exhibition.

There is a short introduction by the commissioner, followed by some data from the census; a list of forty-two gold, fifty-five silver,

Report upon the exhibit of the fisheries and fish-culture of the United States, made at the London fisheries exhibition, 1883. Prepared under the direction of G. BROWN GOODE. (U. S. nat. mus., bull. 27.) Washington, Government, 1884 [1885]. 8°.

and thirty bronze medallists; beside some fifty other awards to American exhibitors, followed by a report on the collective exhibits of the U. S. national museum and the U. S. fish-commission. It is needless to say that every branch of the subject is thoroughly presented, either by specimens, models, illustrations, or literature. There is included under these a useful series of catalogues by Messrs. Rathbun (Economic invertebrates, except mollusks), Ridgway (Water-birds), Winslow (Economic mollusks), Brown (Whale-fishery), Bean (Fishes, and illustrations of fishes), Rathbun (Scientific appliances for deep-sea investigation), True (Aquatic mammals), Capt. Collins (Vessels and boats), Earll (Fishing-tackle and appliances), Clark (Fishery products), and Earll (Fish-culture).

The catalogues of birds and fishes are of particular interest and value, apart from their present connection, to all interested in those departments of biology. The catalogues of mollusks and other invertebrates are necessarily much less complete, and are expanded and improved from the centennial catalogues of Messrs. Dall and Rathbun, prepared for Philadelphia.

The volume is a monument of well-systematized labor, but would probably have been more convenient for reference if it had been divided into two volumes. The anthropologist, ornithologist, ichthyologist, fisherman, or manufacturer can hardly fail to find useful and welcome information in these pages; while, by the staff of the commission and museum, the book can hardly be contemplated without a feeling of thankfulness that the period of extraordinary drudgery, apart from their usual and regular duties, which the volume commemorates, is at last entirely over.

PHYSICS OF THE EARTH.

This is an admirable book. Dr. Günther, whose thoroughness has been well shown in his earlier writings, makes many physicists, mathematicians, and geographers his debtors by preparing so able a work on the subjects where they meet on common ground; and, if all teachers of physical geography and geology had the good fortune to possess the advanced training that this volume gives and requires, we should hear less from the classical men of the insufficient discipline afforded to the scholars in our secondary schools by their natural-his-

Lehrbuch der geophysik und physikalischen geographie. Von SIEGMUND GÜNTHER. Band I. Stuttgart, Enke, 1884. 10+418 p. 8°.

tory studies. A second volume is promised to contain the more geographic topics, while the one now issued treats of terrestrial physics in a more general sense under such headings as the relations of the earth to the other planets, the form of the earth, the effect of its motion, and the condition of its interior. These are preceded by an historical introduction, and followed by a brief and discriminating discussion of volcanoes and earthquakes; and all the chapters are closed by extended lists of citations that add greatly to their value. As indicative of the careful and learned investigation that has been required in the preparation of the work, we cannot do better than give in brief abstract an outline of three discussions on subjects that have not received sufficient attention on this side of the water,—the irregularities of the earth's shape, the effects of its rotary motion, and the hypothesis that its interior is gaseous.

The development of the belief in the globular form of the earth is treated at length; and the reasons for giving up the Cassinian view of its elongated polar diameter and accepting the Newtonian explanation of its polar flattening are clearly stated before mention is made of the difficulties that have been encountered in attempting to reconcile the accurate arc-measurements of modern times with the supposition that the earth must have a regular form. It is then shown, that after it had to be admitted that meridians measured in different countries could not be fitted on any single ellipsoid, and after it was found that mountains exerted a sensible lateral attraction on plumb-lines hung at their bases, it was still supposed, even by such men as Gauss and Bessel, that the ocean was essentially level, and that it would serve as a proper fundamental surface to which measurements of altitude, or distance from the earth's centre, could be referred. During the prevalence of this opinion, through the first third of this century, careful observations of swinging pendulums were made in many parts of the world; for, as the pendulum moves in obedience to gravity, the flattening of the earth could be deduced, it was thought, from the number of oscillations counted in a day at different latitudes. In the course of these difficult experiments, it was found, strangely enough, that pendulums would swing faster on mid-oceanic islands than on the opposite continental coasts: the difference was small, only eight or nine seconds a day; but it was persistent, and, as it implied a greater strength of gravity, it soon led to the conclusion that the earth was denser beneath the

oceans than below the continents. This view is now widely quoted, and it probably will long remain in our text-books; although there can be little doubt that it is quite incorrect, and that the true explanation of the difficulty is to be found in the deformation of the ocean's surface by lateral continental attraction. The most important investigation of this deformity, and of the many difficulties it adds to geodetic work, is by Fischer, in a small volume entitled '*Untersuchungen über die gestalt der erde*' (1868). Saigey, Stokes, and Hann have also considered the question; and, although it is not yet possible to say how much the sea is drawn up on the flanks of the continental masses, it is sufficiently demonstrated that the lifting amounts to many hundred feet on certain coasts. As a result, islands appear in mid-ocean that would be submerged if the ocean's surface were really level; and pendulums must naturally swing faster there than on the coasts, because they are nearer the centre of the earth.

Other important modifications of previous views follow from these conclusions; continental upheaval becomes more of a problem than ever; the great East-Indian arc is considered useless for determining the size and shape of the earth; and Airy's explanation of the absence of lateral attraction by the Himalaya is pronounced incorrect. Evidently, geodesists have still much to do.

Among the consequences of the earth's rotation, Günther gives a full and precise account of the lateral deflection of horizontal motions so conspicuously seen in the oblique motion of the trade-winds. There is not to be found an English text-book on physical geography in which this matter is properly explained: when mentioned, it is almost invariably stated that the deflective force acts only on north or south motions, and is nothing on bodies moving east or west. Even Herschel has explicitly given this meaning. But as a matter of fact, the deflective force is the same, whatever be the direction of motion from a given point, and the demonstration of this unapparent truth is here simply presented. Still a farther step is taken in quoting the results of Finger's recent investigations, where it is shown that on a spheroid, instead of on a sphere, it is not precisely true that the deflective force is independent of the direction of motion: it is greatest for eastward motion; and in confirmation of this, Günther quotes Darapsky, who finds that in artillery practice the observed deflections are greatest when the aim is directly to the east. The variation is extremely small, and

is only apparent in high velocities. For nearly all studies, it will suffice to consider the deflections as if produced on a sphere.

Ritter's speculations concerning the gaseous condition of the earth's interior are of especial importance, inasmuch as they may tend to counteract the very positive statements made by English physicists and geologists in recent years in regard to the age and contraction of the earth as determined by its cooling. The English school generally regards the earth as essentially solid, with a great central volume of dense matter at a high, and, roughly speaking, uniform temperature. On the basis of certain plausible assumptions concerning the original temperature and conductive power of the mass, it has been possible to approximate fairly well to the age for an earth of such characters, and to determine roughly the shortening of its radius, and consequent diminution of circumference since it has had a definite solid crust on which water might condense from the vaporous atmosphere into the oceans. The age of an earth thus limited has greatly reduced the estimates in vogue by the followers of Hutton and Lyell, even though its years are still to be counted by millions. Its contraction from cooling has also been pronounced insufficient to produce the observed structure of mountain ranges in the way that Élie de Beaumont had suggested. Strongly contrasted with these assumptions and their legitimate results are the conclusions reached by Ritter. His original papers were published in Poggen-dorff's 'Annalen,' and have received an approving review from so trustworthy a physicist as Zöppritz. Günther quotes largely from the latter. We cannot here do justice to the hypothesis, for it would need a somewhat deliberate statement to make it clear. Excessively dense vapors, probably dissociated from their ordinary combinations, and existing at temperatures high above their 'critical point,' are supposed to occupy the earth's centre; and from these there is a gradual transition to the solid superficial crust. The cooling of such a central mass follows a paradoxical law,—the more heat it loses, the hotter it becomes,—and so the supply of interior heat is long maintained, and the time allowed for geological processes is lengthened. Moreover, the contractional theory here finds a cause for all the diminution of interior volume demanded by the wrinkling of the crust in mountain ranges. Altogether, while the venturesome hypothesis is very far indeed from any thing like demonstration, its consideration is profitable if it prevent our settling down prematurely to a

fixed belief concerning the condition of the earth's interior.

We shall wait impatiently for the second volume of the work, in which the physics of the air and sea will be discussed; and it will be particularly interesting to see what treatment so learned an author gives to the physical geography of the land.

ROMANES' RESEARCHES ON PRIMITIVE NERVOUS SYSTEMS.

ALL who are interested in the physiology of the nervous system in lower animals will find in this volume a most useful popular contribution to this subject. The book, as the author states, is restricted to experiments made in his own researches; but these are so numerous and varied that it will be found to contain a summary of the most important results in this line of investigation which are at present known.

'Do they feel?' and 'Have they senses?' are questions which are very naturally asked by any one who watches the varied movements of the jelly-fishes, star-fishes, and sea-urchins. A natural credulity prompts one to question whether the medusae, whose bodies contain over ninety-eight per cent of water, have a nervous system, and organs of special sensation. Twenty-five years ago, science would have given a very unsatisfactory answer to these questions; but to-day we have a very accurate knowledge of the anatomy of these structures. With this advance in anatomical knowledge, physiological research has kept pace; and certainly no one has done more than Romanes in this kind of research. Thanks to these advances, we can now reply to our questioner with more confidence than formerly. These animals not only feel, but also have special organs of sight, hearing, and probably smell.

The author puts the anti-vivisectionists in a receptive frame of mind for the work which follows by declaring, in the introduction, that his experiments on living animals involve no pain, and that the "consciousness which is present must be of a commensurately dim and unsuffering kind."

The work is mainly taken up by experiments in excising portions of the body, and noting the effects on the movements of the animal. Many very interesting experiments

Jelly-fish, star-fish, and sea-urchins: being a research on primitive nervous systems. By G. J. ROMANES. New York, Appleton, 1885. (International scientific series.) 12+323 p., illustr. 8°.

on the effects of the application of stimulants — mechanical, electrical, and chemical — are described. The action of poisons upon jelly-fishes shows a wonderful resemblance to that of the same on higher animals. Many conclusive experiments are given to prove that the fatal effects of transferring medusae from salt to fresh water is not due to a difference in density of the two media. A medusa artificially frozen into a solid block of ice, so that ice-crystals are formed in its body, is not killed by the operation.

The observations on the star-fishes and sea-urchins are recorded in a single chapter; yet they are in many respects as interesting as those on the jelly-fishes in the preceding nine chapters. The author points out the different methods adopted by star-fishes and sea-urchins in righting themselves when turned upon their backs. The 'geometrical regularity' of these animals, in their nervous system as in their form, leads to a "very pretty instance in physiology of the physical principle of the parallelogram of forces." If two stimuli are applied simultaneously at opposite extremities of an axis passing horizontally through a round sea-urchin, the Echinus moves off 'in a direction at right angles' to a line connecting these points.

The author finds, that, by cutting off the eye-spots from several star-fishes and sea-urchins, they do not seek the light thrown into the dish, as is invariably their habit when these organs are intact. He also finds that an excised ray of a star-fish makes its way to the beam of light as if it were an entire animal. A star-fish, with all the eye-spots but one removed, crawls to the light.

Romanes ascribes to the star-fish a sense of smell from the following experiments: a star-fish is kept fasting for several days. A piece of shell-fish is then placed in the tank with the animal. He immediately crawled toward it. "Moreover," says the author, "if a small piece of the food were held in a pair of forceps, and gently withdrawn as the star-fish approached it, the animal could be led about the floor of the tank in any direction, just as a hungry dog could be led about by continually withdrawing from his nose a piece of meat as he continually follows it up." To determine the region of the body where the supposed sense of smell is located, the experimenter removed the eye-spots, and the hungry star-fish moved in the direction of its food. He varnished the whole upper (aboral) surface of the body, and still the acuteness of the sense was not diminished. He concludes that the sense is not localized,

except that it is "distributed over the whole of the ventral or lower surface of the animal."

These last-mentioned experiments can be easily tested by any one without elaborate apparatus. Certainly one great value of all the experiments is their great simplicity; and the book has this strong recommendation to contribute to make it, what the author expresses a wish that it should be, a "book of service to the working physiologist."

The work of Romanes is certainly one of the most valuable contributions to the physiology of the primitive nervous system which have been published, and it is the only book on this subject which has yet appeared in America. Yet, much as there is to praise in this book, there are several statements which an anatomist cannot accept; but these do not detract from the excellence of the work, as far as the main questions are concerned.

MINOR BOOK NOTICES.

PROFESSOR JOHNSON'S little book on curve-tracing is more clearly arranged than Frost's treatise, and seems much better suited to the wants of readers who need only a general knowledge of methods, and do not wish to go into refinements of approximation which they may seldom or never have occasion to use. Students rarely think it worth while to spend much time in curve-tracing after they have once acquired a little knowledge of analytic geometry; but every man who means to devote his attention specially to mathematics needs to have some facility in interpreting equations geometrically, and this he can best get by studying some such book as the present one. Professor Johnson treats the analytical triangle in a way which will recommend itself, we feel sure, to mathematicians, and introduces it so early that a person who has time for no more can read the first half of the book to advantage. In a few instances the addition of a short clause would make clear sentences which are now rather obscure.

Pettit's little book gives in a concise form a brief account of nearly all the more important

Curve-tracing in cartesian co-ordinates. By WILLIAM WOOLSEY JOHNSON, professor of mathematics at the U. S. naval academy. New York, Wiley, 1884. 6+86 p. 16°.

Modern reproductive graphic processes. JAMES S. PETTIT. New York, Van Nostrand, 1884. (Van Nostrand sc. ser., No. 76.) 4+127 p. 16°.

Comparative physiology and psychology. A discussion of the evolution and relations of the mind and body of man and animals. By S. V. CLEVINGER, M.D. Chicago, Jansen, McClurg, & Co., 1885. 6+247+10 p. 8°.

Elements of zoology. By C. F. HOLDER and J. B. HOLDER, M.D. New York, Appleton, 1884. (Appleton's sc. text-books.) 10+385 p., illustr. 8°.

modern methods of illustration. Its purpose is to give a general popular knowledge of these processes, rather than to give those explicit directions which would enable one to carry them out in practice. In one or two places the description is not quite clear, as in the account of Mr. Eckstein's process, on p. 45. Again: under 'Instantaneous photography,' the statement of some of the optical phenomena is incorrect. But, with these trifling exceptions, the book is an admirable one, and well adapted, in connection with a course of lectures, to serve as a text-book in our colleges and high schools.

In the preface to Clevenger's 'Comparative physiology,' the author states that "Faraday, Huxley, and Tyndall, in chemistry, biology, and physics, with the host of workers in nerve phenomena, have afforded the materials for the author's work. Darwin and Spencer have taught him how to make use of them." The book shows that the writer reads widely, and thinks about what he reads. But to publish the quotations which have impressed one, with the ideas they have awakened, even if those ideas are apt and original, is hardly wise. The work contains some careful observations which have a bearing upon the doctrine of evolution; but these are presented in such a fragmentary way, and in such an anxiously defensive tone, that it is difficult to appreciate their force. The defect in the book is owing to a lack of power of analysis and synthesis. It has no method of arrangement, and it has no easy grouping of analogous fact. Some pages read like a series of proverbs, each one complete, but out of relation to all the rest (pp. 125-129): hence it is difficult to become interested, as the attention is not held. If one has worked out a system of philosophy which reconciles all the facts of physiology and psychology, it should be carefully digested and arranged before being placed before the world, and then its acceptance will largely depend upon a style which attracts, and a confident power of persuasion which convinces.

The plan laid down by the Holders in the preface to their 'Elements of zoölogy' is excellent. Each branch, class, and order is to be plainly defined, and its difference from preceding ones shown. Available examples are to be chosen, and the student encouraged to personal investigation. The specimens described are, as far as possible, available. But the first promise is almost entirely disregarded. Indeed, the author seems to have such a fear of classification, that the book is a mass of facts, without any apparent system of arrangement.

The descriptions of the lower invertebrate classes are so meagre and unsatisfactory, that it is sometimes impossible to tell exactly what group is intended without reference to the heading of the section, or to the cuts, which are generally excellent. Much less could the average student take any given normal specimen, and, by reference to the text, locate it in its proper class, and find there a clear description of its anatomical structure. Why do nearly all our elementary text-books devote from a third to a fourth of their space to mammals and birds, to the neglect of more available, but rather less familiar groups (e.g., insects), which would furnish an inexhaustible mine of material easily accessible to the student's investigation? The notes on the economic importance of different groups form a new and interesting feature; and the bibliography is excellent, in referring almost altogether to works which should be within reach of every teacher and student.

NOTES AND NEWS.

It is announced that a serious revolt against the Turkish power has arisen in Morocco. Six provinces, or confederated bodies of population, are implicated. The situation is grave, though such matters are not rapidly disposed of in that country. Practically, all that part between the 6th and 7th degrees of west longitude from Paris is to-day independent of the sultan; and the Berâber, indomitable and ferocious, have, both in the north and south, revolted against an authority to which, by the way, they were never entirely submissive. Part of this tribe are mountaineers, like the Kabyles; the rest, equally fierce nomads. Together they can muster twenty or thirty thousand rifles in war-time. Morocco for a long time has contained three large regions which maintained their independence. In the quietest times, only about one-half the area denominated Morocco on the best maps has acknowledged the temporal authority of the sultan. The Berâber, moreover, are the clients and religious adherents of the princely family of Sheik Walad Sidi of Algeria, whose head, long resident in Paris, is now the declared enemy of France, and one of the foremost soldiers of the Sénousian confraternity. From these facts, it is evident that serious consequences might flow from the present disturbances.

—Serpa-Pinto writes from the Mozambique coast, at Port Bocage, that he is about to lead an important scientific expedition into equatorial Africa for Portugal. He will not visit the Kongo, as has been erroneously reported. He will be assisted in astronomical matters by Lieut. Cardozo and Paul Mapp (photographer), a hundred Zulus armed with modern rifles of the best kind, and four hundred porters. His mission is to study the country between the upper

periments having been made with the electric light between Suez and Ismailia. But it happened, unfortunately, that a bright moon was shining on the night when these experiments were made, the result being that the effect of the electric light was lessened.

— Capt. W. H. Hill reports, that while on board the schooner *Elizabeth*, bound from New York to Newbern, N.C., he met with a heavy gale off Hatteras, wind north-east, heavy sea. He could not clear the Diamond, and had to scud through Hatteras Slough. The sea boarded the vessel, and took the bulwarks away. Fearing for the vessel's safety, oil was poured over the stern, a little at a time, from an ordinary stone jug. This at once smoothed the sea's surface, making it partake of the nature of a ground-swell; and the *Elizabeth* went in without shipping any more seas. A brig, seeing the smooth water astern of this vessel, steered for her wake, and ran through under close-reefed topsails, keeping in the smooth water.

— A summary of observations on earthquake phenomena made in Tasmania, during 1883 and 1884, by Commander Shortt of Hobart, records a great number of moderate shocks during these years, although they had been very rare before. Nearly one hundred disturbances were felt at St. Mary's in February, 1884; and over one thousand have been noted at Gould's Country since April 12, 1883, when the first shock was felt there. These small earthquakes are seldom felt outside of the north-eastern part of Tasmania; and their origin seems to be a hundred or more miles out to sea, near the border of the deep waters which separate Australia from New Zealand.

— The Linnean society of New South Wales again offers a prize of one hundred pounds for the best essay on the life-history of the bacillus of typhoid-fever. The essay must be based entirely on original research, the details of which, and of the methods employed, are to be fully explained; to be delivered before Dec. 31, 1885.

— Mr. C. R. Orcutt of San Diego, Cal., proposes to publish from that place a small quarterly journal devoted to the study of shells, crustacea, and radiates, in the interest of students and collectors of the same.

— The Board of trustees of Indiana university selected Prof. John M. Coulter of Wabash college, and editor of the *Botanical gazette*, to fill the chair of botany in that institution; but it is understood he has declined the position.

— In speaking of the erosion of big guns, Capt. Noble recently explained to a representative of the *Pall-mall budget* that the latest era in gun-making dated back to 1877. The great advance then made resulted directly from experiments with powder. We stepped at once from velocities of fifteen hundred feet to the present velocities of from two thousand feet to twenty-three hundred feet per second. The very high charges now employed (eight hundred and thirty pounds of powder have been fired in a single charge from a hundred-ton gun, and three hundred

pounds from a gun not quite twenty-five tons in weight), and the relatively very long time during which the high pressure and the temperature of the explosion are continued, have aggravated to a very serious extent the evils due to erosion, and the consequent rapid wear of the bores of guns. At the moment of explosion the surfaces of the guns in the vicinity of the charge are in a state of fusion. The heated gases passing over these fused surfaces at a high velocity and pressure, absolutely remove that surface, and give rise to that erosion which is so serious an evil in guns where large charges are employed. All guns are now made with a lining, which is taken out when it has been eroded: the operation may occupy from two to three months. The hundred-and-ten gun could not be fired, with a full battering charge (nine hundred pounds of powder), more than a hundred and fifty rounds; but it will fire an almost indefinite number of smaller charges (say, two-thirds of the full charge) without very serious injury resulting.

— Messrs. J. de Brettes and P. Lacabanne-Courrèze left Buenos Ayres in January with the intention of traversing the Grand Chaco at its greatest breadth from Corrientes to Candelaria. Persuaded that the misfortunes of previous explorers were due to the presence with them of a force so large as to excite the suspicions of the Indians, thus bringing on active hostilities, these travellers propose to make the journey, accompanied only by two Indian servants.

— Victor Giraud, having reached Paris on his return from central Africa, was received with *éclat* by a deputation from the Société de géographie; and it is announced, that, in recognition of the energy, perseverance, and courage with which he pursued his explorations, the Ministry of marine have proposed him for the cross of the Legion of honor.

— We have received three pamphlets by Dr. Rollin R. Gregg of Buffalo, entitled 'Diphtheria and bacteria,' 'Professor Pasteur's experiments, bacteria in various diseases,' and 'The revelations of fibrin.' They embody the results of the writer's so-called scientific experiments upon fibrine, of which material he finds all forms of bacteria to be composed. Inasmuch as he gives no reason to suppose that any proper methods of sterilization were employed, and displays his ignorance of the fact that distilled water may be full of micro-organisms, it does not seem possible that these papers will command much attention. Indeed, no such work is worthy of criticism; for the day has passed when the pathogenic properties of bacteria, as such, can be disputed, except as the result of the most careful labor by experts in all the methods of manipulation.

— In the article on 'Roads from India to central Asia,' in our last issue, in the third line of the third paragraph, second column of p. 361, 'northern' should read 'southern;' and in the first line of the fourth paragraph, in the same column, 'to the south' should read 'to the north.' In the next to the last line in the first column of the following page, '1883' should be '1881.'